

REMARKS

In the Office Action issued December 19, 2002, Examiner entered a restriction as to claims 1-12 drawn to a process, and claim 13 drawn to an article. Applicant affirms election of claims 1-12 for examination.

Claims 1-5 and 11-12 are amended. The amended and new claims are fully supported by the description, claims and figures as originally filed. No new matter is added by the amendments and new claims.

Briefly, Applicant's invention is a method for highly precise cutting of a glass sheet. A glass sheet is heated by a laser above its glass transition temperature along a cutting line followed by cooling. After the laser treatment, the glass along the cutting line has a larger specific volume than adjacent glass and protrudes from the sheet. An etching solution is applied and the glass along the cutting line is preferentially dissolved forming a groove having beveled edges. The groove may have a U-shape or if the laser is inclined to a line normal to the surface of the sheet, a conical shape. The glass sheet is broken along the groove without forming chips or dust that can contaminate product surfaces. Further, the beveled edges of the broken surfaces eliminate the need for a separate beveling step.

Claims 1-3, 4-6 and 9 are rejected under 35 U.S.C. §103(a) as being unpatentable over Matanabe et al., US 4,999,083 in view of Allaire et al., US 6,327,875 and Davis et al., US 5,809,006. Applicant traverses the rejection to the extent that it can be maintained.

Applicant respectfully submits that Examiner has failed to present a *prima facie* case of obviousness. Three basic criteria must be met to establish a *prima facie* case of obviousness:

1. There must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine the references teaching without hindsight to the claimed invention.
2. There must be a reasonable expectation of success.
3. The prior art references must teach or suggest all of the claim limitations.

See *In re Vaeck*, 20 USPQ2d 1438 (Fed. Cir. 1991); MPEP § 2143 et seq.

First, there is no motivation to combine the references as to do so would destroy the intended function of Watanabe et al.. Second, even if combinable, there is no reasonable expectation of success.

Watanabe et al. disclose a method for creating a groove or hollow in crystalline or polycrystalline material such as Si crystal, Ge crystal, etc. (Summary of the Invention, and column 3 line 62 to column 4 line 5). Glass is an amorphous material by definition. There is no teaching or suggestion in Watanabe et al. that their method could be used to etch glass.

Watanabe et al. employ an ion beam to inject ions into a crystalline substrate to create an amorphous region that can be selectively etched from the crystalline substrate. However, there is no teaching or suggestion that the method of Watanabe et al. can be applied to an amorphous substrate. Even if ions could be injected into glass, a point that Applicant does not concede, there is no teaching or suggestion that an amorphous region different from the amorphous substrate would form thereby enabling selective etching.

The secondary references do not remedy the deficiencies of Watanabe et al.. Allaire et al. uses a laser beam to heat a glass sheet followed by coolant to form a shallow crack. The sheet is then separated into smaller sheets by applying a bending movement to the crack. In sharp contrast, Applicant uses a laser to heat glass along a cutting line thereby forming a protrusion that can be selectively etched to form a groove. Allaire et al. and Applicant each use a laser to accomplish a different purpose and there is no teaching by Allaire et al. that a laser could be used to accomplish Applicant's purpose. Further, combining Allaire et al. with Watanabe et al. would destroy the intended function of Watanabe et al.. A laser beam is not an ion injecting beam and cannot inject ions into a crystalline substrate.

Davis et al. disclose that an ion beam or a laser can be used interchangeably to pattern a photoresist (column 1 lines 57-66). Applicant disagrees with Examiner's contention that an ion beam and a laser may be freely substituted one for another regardless of the application. As stated above, the use of a laser by Watanabe et al. would render their method inoperative.

Watanabe et al., US 4,999,083 in view of Allaire et al., US 6,327,875 and Davis et al., US 5,809,006 are simply not combinable for the reasons stated and, even if combined, do not teach the claimed invention. Examiner's conclusory statement that by heating and immediately cooling, the amorphous structure is certain to form and provide for easy etching and separation is without evidentiary support. The factual question of motivation to combine references cannot be resolved on subjective belief. Factual findings, fully explained, to support Examiner's conclusion must be provided. See *In re Lee*, 61 USPQ2d 1430 (Fed. Cir. 2002) Examiner is respectfully requested to withdraw the rejection of claim 1 on this ground.

Claims 2-3, 4-6 and 9 depend from independent claim 1. It is axiomatic that dependent claims are allowable if the claim from which they depend is allowable. Applicant submits that for this reason alone claims 2-3, 4-6 and 9 are allowable. With respect to the use of two lasers for heating opposite sides of a glass sheet simultaneously, Examiner asserts that it would have been obvious to do so to provide a quicker heating mechanism to form a crack. Applicant's method does not use lasers to form cracks. Applicant's method uses lasers to provide regions selectively soluble by an etching agent. Further, as illustrated by figure 5 and described at page 1, two lasers provide grooves on the upper and lower surfaces of the glass that provide beveled edges on both upper and lower surfaces after separation.

Claims 7-8 are rejected under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al., US 4,999,083 in view of Allaire et al., US 6,327,875 , Davis et al., US 5,809,006 and JP 63-0734. Applicant traverses the rejection to the extent that it can be maintained.

The teachings Watanabe et al., US 4,999,083 in view of Allaire et al., US 6,327,875 and Davis et al., US 5,809,006 are discussed above. The Japanese reference discloses the use of ammonium fluoride as an etching agent for glass. There is no teaching or suggestion in the Japanese reference that ammonium fluoride solution is a suitable etching agent for the substrates taught by Watanabe et al.. Watanabe et al. simply state that the selection of etchant is related to the substrate, injected ions, and ion injecting conditions (column 4 lines 16-28) and is apparently selected on a trial and error basis. Watanabe et al. disclose 85 % phosphoric acid as an example. There is no motivation to combine the Japanese reference with Watanabe et al. without some suggestion that ammonium fluoride is a suitable etching agent for the substrates disclosed by

Watanabe et al.. Applicant submits that the Japanese reference is not combinable with Watanabe et al.. Also, claims 7-8 depend directly or indirectly from claim 1; and as explained above dependent claims are allowable if the claim from which they depend is allowable. Applicant requests Examiner to withdraw the rejection of claims 7-8 on this ground.

Claims 10-11 are rejected under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al., US 4,999,083 in view of Allaire et al., US 6,327,875 , Davis et al., US 5,809,006 and Nishikawa et al, US 5,138,131. Applicant traverses the rejection to the extent that it can be maintained.

Nishikawa et al. is cited for teaching the forming of a circular shape by using a laser. While this may be so, the laser is used to heat glass along a scribing line to induce thermal stress thereby cracking the glass along the scribe line (column 2 lines 18-27). Considering the reference as a whole, its teachings are not combinable with Watanabe et al. as Watanabe et al. teach a method for etching a crystalline material, not cracking the material. Also, claims 10-11 depend directly or indirectly from claim 1, and as explained above dependent claims are allowable if the claim from which they depend is allowable. Applicant requests Examiner to withdraw the rejection of claims 10-11 on this ground.

Claim 12 is rejected under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al., US 4,999,083 in view of Allaire et al., US 6,327,875 , Davis et al., US 5,809,006, Nishikawa et al, US 5,138,131 and Hafner, US 3,453,097. Applicant traverses the rejection to the extent that it can be maintained.

Hafner is cited for teaching application of a laser at an angle to the normal during a cutting operation. As noted above, Watanabe et al. do not (cannot) us a laser in their method. Further, Watanabe et al. disclose a method for etching crystalline material, not cutting glass. There is no motivation to combine the teachings of Watanabe et al. with Hafner as the combination would destroy the intended function of Watanabe et al.. Also, claim 12 depends directly or indirectly from claim 1, and as explained above dependent claims are allowable if the claim from which they depend is allowable. Applicant requests Examiner to withdraw the rejection of claim 12 on this ground.

New claims 14-16 are presented. These claims depend directly or indirectly from claim 1 and recite additional features resulting from Applicant's method. These features are not taught or suggested by the references of record. Applicant respectfully submits that new claims 14-16 are allowable.

Applicant respectfully submits that the new and amended claims are allowable and request prompt passage to allowance.

Attached hereto is a marked-up version of the changes made to the specification. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicants' primary attorney-of record, Curtis B. Hamre

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Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims

1. (AMENDED) A process for cutting a glass sheet, comprising the steps of:

heat treating a glass sheet to be cut by first applying at least one laser beam onto [its] a surface of the glass sheet and scanning [it] the laser beam along a cutting line along which [said] the glass sheet is to be cut, so that a sheet portion including said cutting line may be heated to a temperature equal to, or above [its] a glass transition point of the glass sheet, and then cooled to have] cooling the sheet portion to thereby cause the sheet portion to protrude from the remaining portion of the glass sheet, the protruding sheet portion having a larger specific volume and a lower density than [which is larger than that of] the remaining portion of the glass sheet;

etching [said] the heat-treated sheet to form a groove [along] in and along the sheet portion including said cutting line; and

breaking [said] the glass sheet along said groove.

2. (AMENDED) The process according to claim 1, wherein said temperature is lower than the melting temperature of [said] the glass sheet.

3. (AMENDED) The process according to claim 1, wherein two laser beams facing each other are employed for heating [the two] opposite surfaces of [said] the glass sheet simultaneously.

4. (AMENDED) The process according to claim 1, wherein said cooling is forced cooling and achieved immediately after said heating.

5. (AMENDED) The process according to claim 4, wherein said cooling employs pressurized air as a coolant.

11. (AMENDED) The process according to claim 10, wherein said curve is a [true] circle.

12. (AMENDED) The process according to claim 10, wherein said laser beam is inclined to a line normal to said surface of [said] the glass sheet so that said groove may present a conical, or likewise tapered surface.

Please enter new claims 14-16.

